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Vol. 43 No. 4

BULLETIN

OF THE

TORREY BOTANICAL CLUB

APRIL, 1916

Notes on species of Halymenia

F. S. Collins and M. A. Howe

In connection with studies of a series of specimens of red algae of the genus *Halymenia* from Bermuda, southern Florida, and North Carolina, we have been forced to recognize as entitled to specific rank four striking and apparently well-defined forms that we are venturing to describe as new. One of these is related to *Halymenia floridana* J. Ag., two find their closest affinity in *H. Floresia* (Clem.) Ag., and the fourth is allied to *H. actinophysa* M. A. Howe. Descriptions follow:

Halymenia bermudensis sp. nov.

Thallo violaceo-rubro, plerumque stipitato; stipite inferne subtereti, superne complanato vel costato-alato, interdum ramoso, plus minusve elongato; fronde membranacea, firma, levi, nec nitente, 60–120 μ crassa, suborbiculari, cordata vel obovata, saepe, interdum repetite, lobata vel prolifera, divisionibus frondi primariae conformibus; margine plana vel plicata, subintegra, crenata, vel interdum irregulariter dentata; medulla frondis subcompacta, inter fila tenuiora filis crassioribus stellatim radiatis frequenter sparsis; strato corticali frondis series 1–3 cellularum minorum monstrante; strato subcorticali series 1–3 cellularum majorum monstrante; tetrasporangiis sparsis; cystocarpiis ignotis.

Species *H. floridanae* J. Ag. proxima, sed differt colore magis saturate violaceo-rubro, minus roseo, fronde magis dissecta, substantia firmiore, cortice crassiore, firmiore, saepe pleiostromatico.

[The Bulletin for March (43: 117–168. *pl. 4–6*) was issued April 14, 1916.]

Ad oras Insularum Bermudensium (typum legit F. S. Collins, Apr. 25, 1912, no. 7074).

Thallus usually stipitate; stipe commonly 2–10 mm. long, 0.45–0.75 mm. thick, subterete below, complanate or costate-alate above, sometimes branched, occasionally more elongate and subrhizomatous; frond membranous, rather firm or slightly gelatinous, 60–120 μ thick, variable in form, suborbicular, cordate, or obovate, attaining a width of 4–30 cm., subentire, or sparingly or copiously lobed or proliferous, the lobes or proliferations conformable or ovate, themselves sometimes once or twice lobed in similar fashion, the proliferations often stipitate, the apices rounded-obtuse, the margins plane or more or less ruffled-plicate, subentire, lightly sinuate-crenate, or now and then irregularly coarsely or obscurely dentate; surface dull or rarely subnitent, smooth; color (dried) violet-red (rosolane-purple to Indian lake*); medulla of stipe compact, sometimes pseudoparenchymatous, 0.15–0.45 mm. thick; cortex of stipe or of its costa very firm, compact, parenchymatous, 8–30 cells thick, its cells in distinct anticlinal rows, cells of subcortex larger and irregularly disposed; medulla of frond moderately compact, its filaments mostly 3–8 μ in diameter, usually interspersed (in older parts at least) with coarser filaments, 6–20 μ in diameter, having more homogeneous refringent contents, such filaments radiating from substellate ganglion-like enlargements 15–65 μ in diameter; cortex of frond parenchymatous or subparenchymatous, 1–3 cells thick, the cells usually firm-walled, subquadrate in section, the superficial cells angular, mostly 5–10 μ in diameter in surface view, their outer walls 2–4 μ thick, protoplasts close (separated 2–3 μ), subcortex 1–3 cells thick, its cells mostly 13–25 μ in diameter; tetrasporangia 12–16 $\mu \times$ 8–10 μ; cystocarps unknown.

BERMUDA: In shallow water in clefts of rocks and caves and among roots of *Rhizophora; A. F. Kemp*, August, 1856 (as *Rhodymenia palmata*); Walsingham, *W. G. Farlow*, February, 1881; near Hamilton, *M. A. Howe 69*, June 12, 1900; Stokes Bay, Tucker's Town, *M. A. Howe 313*, July 6, 1900; Harrington Sound, *A. B. Hervey*, January 15, 1913; Dingle Bay, *A. B. Hervey*, March 30, 1915; Grasmere, *A. B. Hervey*, March 9, 1914; Old Ferry, *A. B. Hervey*, April 2, 1913; Castle Harbor, *F. S. Collins*, April 25, 1912 (Phyc. Bor.-Am. *2050*), and May 3, 1913.

TYPE: Castle Harbor, near Tucker's Town, April 25, 1912, *F. S. Collins 7074*, in herb. F. S. Collins.

* Ridgway, R. Color standards and color nomenclature *pl. 26*. 1912.

This species seems to be fairly common in Bermuda. Its favorite habitat is the walls of narrow deep clefts in the shore cliffs, such as are found between Tucker's Town and Walsingham. Here it grows from a little below low-water mark down at least to a depth of two or three meters, usually as single separate plants rather than in dense tufts. It seems to thrive best where much shaded. In an unattached condition it occurs also among mangrove roots, as in the vicinity of Hamilton. These loose fronds are darker in color, firmer in texture, and less adherent to paper when dried under pressure than are the attached forms. There is much variation in the form of the frond; the primary form seems to be orbicular and plane with a slightly developed stipe. Rapid marginal growth of the frond results in ruffles and plications, and when these are well developed the plant has somewhat the aspect of *Porphyra amplissima* in miniature. In color and habit it is often suggestive also of certain conditions of *Callymenia reniformis*, from which, however, it differs markedly in structure. Proliferous growth is common; the proliferations are sometimes sessile but are oftener stipitate, the stipe terete or flattened, in the latter case with or without an obvious costa, which may be continued into the base of the main expansion. In the older plants, under certain conditions of growth, the basal stipe, terete or flattened, may branch and form a matted subrhizomatous complex from which individual fronds arise, these usually orbicular or cuneate, or sometimes cordate from a cuneate base. An important character of this species is the presence, in the medulla, of conspicuous stellate ganglia more or less similar to those exhibited by the type specimen of *Halymenia floridana* J. Ag. and by *Sebdenia heteronema* M. A. Howe.* These may be easily observed through the cortex by transmitted reduced light under low-power lenses without the use of any staining reagents; however, their protoplasts have a peculiar affinity for haematoxylin stains and they may be differentiated with remarkable distinctness by overstaining with preparations of haematoxylin and afterwards partly decolorizing. The nodes of the ganglia are irregularly stellate or subglobose; from each of them radiate three to ten coarse rather rigid and straight tapering filaments with dense homogeneous refringent contents; in the

* Mem. Torrey Club 15: 163–165. *pl. 58.* 1914.

less developed conditions these radiating arms seem to lose themselves among the ordinary filaments of the medulla, but in older well-developed states some of these radiating arms may be traced directly to other ganglia, which thus form an interconnecting system. When a portion of the thallus is crushed on a glass slide and the other parts are reduced to a confused mass these ganglia and their rays often persist with little change. Septa in these enlarged specialized filaments are distant and irregularly placed. We have seen but few tetraspores and these were apparently not very well developed. Cystocarps have not been observed, although hundreds of specimens have been examined with the hope of finding them. In one lot of material, however, from Grasmere, we found small red spots resembling cystocarps under a hand lens, but these spots were apparently caused by the irritation of some endophyte or through injury by some small animal.

Halymenia bermudensis evidently finds its nearest ally in the little-known *H. floridana* J. Ag.,* with the type of which, as also with the Peruvian *Sebdenia heteronema* M. A. Howe,† it shows more or less agreement in having usually rather conspicuous substellate medullary ganglia. It differs, however, from *H. floridana*, which is now known only from southern Florida and from near Beaufort, North Carolina (*W. D. Hoyt*), in its darker color (rosolane purple rather than pinkish vinaceous), in its commonly more lobed or dissected thallus, in its rather firmer texture, in its thicker, firmer, and less monostromatic cortex, and in its possible loss of sexual reproduction. Although, in a general way, the two species show a similarity in the medullary ganglia and the dimorphous medullary filaments, a critical comparison shows certain points of difference in these organs. The ganglia are less numerous, less conspicuous, and less obviously anastomosing in *H. bermudensis*. The arms on leaving the ganglion commonly taper away gradually, usually without a septum or obvious interruption of the protoplast; in *H. floridana*, the arms usually taper towards the ganglion and usually have a septum or a wide interruption of the protoplast near the place of emergence. As a result of these

* Anal. Alg. 59. 1892. Howe, Bull. Torrey Club **38**: 511. 1911; Mem. Torrey Club **15**: 164. 1914.

† Loc. cit.

peculiarities, the outline of the central node or ganglion in *H. bermudensis* is, when viewed through the cortex, more lobed, stellate, or brachiate, and less orbicular or rotate than in *H. floridana*.

J. Agardh founded *Halymenia floridana* on several specimens sent to him from Florida by Mrs. Floretta C. Curtiss, and he appears to have put certain specimens of the same thing, or of the typical thing, in the "*Kallymenia reniformis*" cover in his herbarium. Specimens of it, collected by A. H. Curtiss at Gilbert's Bar, Florida, were distributed by Curtiss with a printed "Algae Floridanae" label under the name "*Kallymenia reniformis* J. Ag.," from which plant it differs greatly in structure. *Halymenia floridana* and *H. bermudensis*, however, differ from typical *Halymenia* (*H. Floresia*) in their firmer subparenchymatous cortex, in their much firmer, non-deliquescent and scarcely gelatinous outer walls of the superficial cells, and in the striking development of the medullary ganglia. It is possible, as has already been hinted by one of us,* that more critical studies, especially of the development of the cystocarps (abundant in *H. floridana*), may furnish adequate grounds for the establishment of a new generic group which would include not only *Halymenia floridana* and *H. bermudensis* but also the Peruvian *Sebdenia heteronema*. J. Agardh placed *Halymenia floridana* in his section *Halarachnion* of the genus *Halymenia*, and De-Toni† has ranged it, with a question mark, under the generic name *Halarachnion*, but the type of *Halarachnion* (*H. ligulatum*) has no medullary ganglia comparable with those of *Halymenia floridana* and it differs also in the structure of the cortex.

Halymenia bermudensis may or may not adhere to paper when dried under pressure.

Halymenia Gelinaria sp. nov.

Thallo roseo-vinaceo vel vinaceo-purpureo, brevi-stipitato; stipite a disco basali orto, inferne subtereti, superne cuneato; fronde plana, levi, nec nitente, membranacea vel subcarnosa, plerumque maxime gelatinosa, 60–600 μ crassa, suborbiculari, oblonga, ovata vel cuneato-obovata, latitudine 5 cm. usque 6 dm.,

* Howe, Mem. Torrey Club **15**: 165. 1914.

† Syll. Alg. **4**: 1655. 1905.

simplice vel parce subconformiter divisa, margine plana, integra vel irregulariter dentata aut crenulata, nonnunquam fimbriata; medulla frondis laxa vel subvacua, filamentis transversalibus crebris, filis stellatis paucis et inconspicuis; strato subcorticali dense filamentoso, filamentis anastomosantibus, cellulis nodalibus majoribus; strato corticali series 1–4 cellularum monstrante, parietibus cellularum mollissimis, gelatinoso-deliquescentibus; tetrasporangiis decussatim divisis; cystocarpiis numerosis, minutis, ad una pagina frondis plerumque prominulis, massa sporarum turbinata, 120–140 μ diam.

Species colore, habitu, cystocarpiorum forma, *H. floridanae* J. Ag. proxima, sed differt thallo multo magis gelatinoso, plerumque crassiore, cortice manifeste filamentoso, nec pseudoparenchymato, filis stellatis minus evolutis. Structura *H. Floresiae* (Clem.) Ag. similis, habitu differt, fronde latiore integra vel subintegra, nec regulariter pinnata.

Ad oras Floridae et Carolinae Septentrionalis (typum legit M. A. Howe in loco "Jupiter Inlet" dicto ad oras Floridae, Oct, 13, 1902, no. 1252).

Thallus short-stipitate from a small basal disk; stipe 3–5 mm. long, 0.75–1.2 mm. thick, cuneate from a subterete base; frond plane, membranous or carnose-membranous, usually very gelatinous, 60–600* μ thick, suborbicular, oblong, ovate, or cuneate-obovate, attaining a width of 5 cm. to 6 dm., subentire or rather sparingly (usually conformably) parted, lobed, or proliferous, the margins entire or very irregularly lobulate, dentate, erose-crenulate, or occasionally laciniate-fimbriate; surface dull, smooth; color pinkish vinaceous, rocellin-purple, vinaceous purple, or deep hellebore-red;† medulla of stipe 0.45–0.75 mm. thick, moderately compact, gelatinous; cortex of stipe gelatinous, mostly 8–15 cells thick; medulla of frond moderately compact or subvacuous, its filaments mostly 8–14 μ in diameter, many of them obliquely transverse, connecting the opposite subcortical layers, the cells mostly 20–70 μ long, the medulla occasionally showing a few rather inconspicuous stellate ganglia with nodes 20–40 μ in diameter and slender, elongate, rigid, straight or flexuous, now and then tortuous or nodulose, usually long-celled, radiating filaments, these commonly 4–7 μ in diameter, the ganglionic system with

* The minimum is drawn from the thinner parts of dried specimens, as shown when sections are soaked out with water; the maximum is from the older parts as shown in formalin-preserved material.

† Ridgway, loc. cit. *pl. 27 and 38.*

more homogeneous refringent protoplasts; cortex and subcortex of frond rather distinctly filamentous; subcortex consisting of a close network of anastomosing filaments, the stellately branched nodal cells mostly 13–20 μ in diameter; cortex 1–4 cells thick, the superficial cells (protoplasts) 3–10 μ in diameter in surface view, mostly obtuse and more or less isodiametric, sometimes broader than high, or, 1.5–2 times higher than broad and subacute, often segregated in groups of 2–8, their outer walls very gelatinous and deliquescent; tetrasporangia (protoplasts) 18–26 $\mu \times 13$ μ, the spores decussately paired; cystocarps numerous, minute, commonly slightly protuberant on one face, the spore-mass turbinate, 120–240 μ in diameter.

FLORIDA: Unattached, Jupiter Inlet, *Mrs. G. A. Hall*, September 14, 1896 (Phyc. Bor.-Am. *749b* and *749c*, as *H. floridana*); *M. A. Howe 1252–1255*, October 13, 1902; Indian River Inlet, *Mrs. G. A. Hall*, May, 1899 (Phyc. Bor.-Am. *749a*, as *H. floridana*, and *750*, as *H. floridana*, forma *dentata*); Key West, *Mrs. G. A. Hall.*

NORTH CAROLINA: Bogue Beach, Beaufort, *W. D. Hoyt*, August 12 and 16, 1907.

TYPE: Jupiter Inlet, Florida, October 13, 1902, *M. A. Howe 1252*, sheet C, in herb. N. Y. Botanical Garden.

The plant is known locally in the Jupiter Inlet region as the "beefsteak" seaweed. In form and color of the thallus, as well as in size and form of the cystocarps, *Halymenia Gelinaria* bears a remarkable resemblance to *H. floridana;* in fact, for two species that differ so much in the structure of the cortex, the similarity is astonishing. The affinities of *H. Gelinaria* are, however, clearly with *H. Floresia*, a species that it resembles much less in general habit. From *H. Floresia*, it differs chiefly in forming broad, entire or subentire membranes, which may reach a length or width of 60 cm., and in the less often acute, more isodiametric, superficial cells. *H. Floresia*, in typical forms, was found floating with it in Jupiter Inlet (*Howe 1231*) without intergrading conditions. When lobules, proliferations, or teeth occur in *H. Gelinaria*, they are very irregularly disposed, while in *H. Floresia* the branching is manifestly pinnate, or rather, bi–tri-pinnate. The main axes in *H. Floresia* may vary a good deal in width, but we have never seen them any broader than 7 cm. and they are rarely more than

2 or 3 cm. in width. From *Halymenia floridana*, *H. Gelinaria* differs in the much more gelatinous, often thicker, thallus, in the less firm, obviously filamentous rather than parenchymatous or subparenchymatous cortex, in the deliquescent outer walls of the superficial cells, in the longer cells of the medullary filaments, and in the comparatively rare and inconspicuous and differently shaped medullary ganglia. In *H. floridana* the freely anastomosing medullary ganglia are, with proper illumination or with differential staining* the most conspicuous anatomical feature of the thallus; their radiating branches are coarser than the ordinary medullary filaments and the ganglionic system looks like a sort of skeleton or framework about which the rest of the thallus has been filled in. In *H. Gelinaria*, small stellate cells, with ordinary unspecialized protoplasts are normal elements of the subcortex, but larger specialized stellate ganglia of the medulla with refringent protoplasts are rare or occasional and are not usually obvious without a special search; their radiating branches are commonly more slender than the ordinary medullary filaments among which they make their way; these branches rarely anastomose, commonly showing free ends, and they are, perhaps, rather more suggestive of medullary rhizoids than parts of a primary framework, yet they seem to differ from the medullary rhizoids of the Florideae in general in being straighter and more rigid, and in having denser more homogeneous refringent protoplasts. Medullary ganglia of a somewhat similar sort are of occasional occurrence in *H. Floresia* also. The difference between *H. Gelinaria* and *H. floridana* as to the character of the cortex comes out strongly when a section is made or even when a margin or a fold of the surface is examined microscopically; in *H. Gelinaria*, the dissolving away of the outer walls of the superficial cells leaves these cells more or less isolated and separate, so that the general surface appears minutely papillate, while in *H. floridana* under the same conditions the general surface is covered by a firm cuticle and is perfectly smooth. The cystocarps of *H. floridana* and *H. Gelinaria* appear to be very similar in form, size, and structure, but it is possible that an exhaustive study of the earlier stages of their development might reveal differences as marked

* See page 171.

as are shown by a microscopic comparison of the vegetative characters of these two superficially similar plants. The cystocarp of *H. floridana*, however, is commonly somewhat protuberant on both faces of the frond, while that of *H. Gelinaria* is commonly protuberant on only one face. In both, the spore-mass or "nucleus" is very dense, turbinate or oblate-spheroid, sometimes apparently two- or three-lobed, and is supported by a short stalk.

In 1900 (Phyc. Bor-Am. 750) the senior author of the present paper used the name "*Halymenia floridana* forma *dentata* (Crouan) Collins" for a dentate-margined condition of the present species, citing *Gelinaria dentata* Crouan in Mazé & Schramm, Algues de Guadeloupe, as a synonym. In doing this he was, in effect, adopting the opinion (expressed *in litt.*) of a distinguished phycologist who was familiar with the Guadeloupe specimens distributed by Mazé & Schramm but knew *Halymenia floridana* J. Ag. from description only. However, the Mazé, Alg. Guad. no. 1602, "Capesterre, Plage du bourg" in the herbarium of the British Museum, is certainly very different, as to species, at least, from either *H. floridana* or *H. Gelinaria*. Whatever may be the relation of other Guadeloupe specimens to these two species, the name *dentata* of Crouan, a "nomen seminudum" at best, can not, under the provisions of the "American Code" at least, be adopted for either, on account of the previously published *Halymenia dentata* Suhr.

Halymenia Gelinaria adheres very firmly to paper when dried under pressure.

Halymenia pseudofloresia sp. nov.

Thallo violaceo-rubro, brevi-stipitata; stipite inferne subtereti, superne cuneato; fronde juvenili membranacea, gelatinosa, aetate provecta firmiore et subcoriacea, 50–450 μ crassa, circumscriptione suborbiculari, ovata, cuneato-obovata, vel nonnunquam valde irregulari, longitudine 7–30 cm., profunde lobata vel prolificationibus stipitatis munita; rachidibus 1–8 cm. latis, lobis et prolificationibus plerumque lanceolatis, serratis vel seriebus loborum etc. secundariorum munitis; superficie haud nitente, plerumque plana, sed aetate provecta minute verruculosa; medulla frondis laxa, subvacua, filamentis sparsis percursa, filamentis transversalibus crebris, filamentis stellatis paucis, inconspicuis; strato subcorticali indistincte filamentoso, cellulis 20–50 μ diam.; strato

corticali cellularum minorum 2–6 series monstrante, cellulis superficialibus aetate elongatis, obconicis vel clavato-truncatis, denique diametro plerumque 2–5-plo longioribus, parietibus externalibus gelatinosis, deliquescentibus; tetrasporangiis decussatim divisis; cystocarpiis ignotis.

Ab *H. Floresia* (Clem.) Ag. et *H. Gelinaria* Collins & Howe differt colore magis saturate rubro vel violaceo-rubro, fronde denique firmiore, subcoriacea, nonnunquam verruculosa, cellulis terminalibus filorum corticalium clavato-truncatis. Frons *H. pseudofloresiae* magis divisa est quam *H. Gelinariae*, minus et minus regulariter quam *H. Floresiae*.

Ad oras Insularum Bermudensium (typum legit A. B. Hervey, Jan. 15, 1915).

Thallus short-stipitate; stipe* 5–10 mm. long, 1–2 mm. thick, cuneate from a subterete base; frond membranous and gelatinous in younger parts, becoming firmer and subcoriaceous with age, 50–450 μ thick, suborbicular, ovate, cuneate-obovate, or commonly very irregular in general outline, attaining a length of 7–30 cm., deeply, irregularly, or subpalmately lobed, or often showing cuneate-based substipitate marginal proliferations, the main expansions or axes 1–8 cm. broad, the lobes or proliferations commonly lanceolate, serrate, biserrate, or subpinnately lobulate or bilobulate, the teeth mostly acuminate-deltoid; surface dull, mostly smooth, but often becoming rugose and minutely and copiously verruculose with age; color (when dried) daphne-red, becoming deep hellebore-red or neutral red† in old fronds; medulla of stipe 0.75–1.0 mm. thick, moderately compact; cortex of stipe rather firm, subparenchymatous, mostly 20–40 cells thick; medulla of frond mostly rather loose or subvacuous, its filaments 10–16 μ in diameter, many of them obliquely transverse, connecting the opposite subcortical layers, the cells 25–90 μ long, the medulla or inner subcortex occasionally showing a few inconspicuous stellate ganglia with nodes 20–40 μ in diameter and slender long-celled branches 2–5 μ in diameter; cortex and subcortex rather firm and solid, obscurely filamentous; cells of subcortex ellipsoidal, mostly 20–50 μ in diameter, obscurely anastomosing or concatenate; cortex 2–6 cells thick, the superficial cells (protoplasts) 4–13 μ in diameter in surface view, angular, obtuse, subisodiametric or often broader than high in younger parts, becoming columnar, obtuse, acute, or acuminate, and finally, for the most

* A well-developed original stipe has been seen in only one case.

† Ridgway, loc. cit., *pl. 38*.

part, obconic or clavate-truncate and 2–5 times higher than broad, their outer walls gelatinous or deliquescent; tetrasporangia (protoplasts) 14–26 μ × 12–14 μ, the spores decussately paired; cystocarps unknown.

BERMUDA: *W. G. Farlow*, 1881; Green Bay, *W. S. Wadsworth*, February, 1890; Castle Harbor, near Tucker's Town, *F. S. Collins 7075*, April 25, 1912; Walsingham, *A. B. Hervey*, January 15, 1915 (Phyc. Bor.-Am. *2099*).

TYPE: Walsingham, *A. B. Hervey*, January 15, 1915, in herb. F. S. Collins.

Halymenia pseudofloresia differs from both *H. Floresia* and *H. Gelinaria* in its normally deeper red color, in the firmer subcoriaceous texture and verruculose surface of its older fronds, and in the mostly clavate-truncate and much elongate superficial cells of the older parts of its frond. From *H. Floresia*, which apparently occurs in southern Florida and the West Indies, as well as in the Mediterranean and adjacent regions, it differs also in the less deeply dissected frond, with the teeth or ultimate lobules mostly acuminate-deltoid from a broad base rather than mostly lanceolate, ligulate, or ciliiform from a somewhat constricted base. Lanceolate outgrowths from a narrowed base are of occasional occurrence, but such seem to have more the habit and nature of proliferations than of normal lobes and lobules. From *Halymenia Gelinaria*, *H. pseudofloresia* differs furthermore in its more lobed and dissected and more obviously pinnate frond and in its firmer, less distinctly filamentous cortex.

The older parts of *Halymenia pseudofloresia*, at least as shown in the Walsingham specimens collected by Hervey, are infested by four or five kinds of endophytic algae, and we have sometimes suspected that the small verrucae referred to in our description as occurring on the old fronds might be caused by irritation due to their presence. However, most of these verruculae appear to be free from any endophyte and we have thought best to treat them as more or less normal parts of the old frond. We have not observed any tendency of these verrucae of the general surface to develop into proliferations, even though the marginal proliferations commonly spring from somewhat similar outgrowths. These surface verruculae are dense, dark red, and about 0.2–

0.6 mm. in diameter, and to the naked eye they sometimes look a little as if they might be cystocarps. A filamentous short-celled Rhodophyceous endophyte sometimes forms dense subglobose or irregularly lobed glomeruli in the medulla and these also may have the superficial appearance of being cystocarps of the *Halymenia*.

Halymenia pseudofloresia, like *H. bermudensis*, is commonly found in an unattached condition, and possibly the absence of cystocarps is in some way associated with this fact. The senior author has noted that *Delesseria sinuosa* and certain other membranaceous Rhodophyceae are commonly sterile when found in places where they have apparently been vegetating for some time unattached.

Specimens of *Halymenia pseudofloresia*, with occasional exceptions as to parts of the old fronds, adhere firmly to paper when dried under pressure.

Halymenia echinophysa sp. nov.

Thallo pallido-vinaceo vel lilacino, membranaceo, gelatinoso, 125–200 μ crasso (madefacto), circumscriptione suborbiculari, 10–18 cm. diam., profunde, irregulariter vel subpalmatim lobato, lobis irregulariter obovatis vel suborbicularibus, marginibus sinuato- vel eroso-dentatis; medulla frondis subvacua vel laxe filamentosa, filamentis homogeneis, 10–14 μ diam.; strato corticali gelatinoso translucido, submonostromatico, cellulis superficialibus ovoideis, subglobosis vel ellipsoideis, 4–8 μ diam. max., 5–10 μ inter se distantibus, in membrana communi horizontaliter vel verticaliter positis, parietibus exterioribus (vel membrana superficiali extra-cellulari) 10–18 μ crassis; strato subcorticali 2–4-stromatico, cellulis arcte anastomosantibus, ovoideis, ellipsoideis, vel interdum complanatis, extimis 6–10 μ diam., intimis 25–65 μ diam. max., nonnullis subglobosis, 80–180 μ diam., echinato-stellatis, in medullam protrudentibus, processubus 15–40, subrigidis, subspinescentibus, munitis.

Species *H. actinophysae* M. A. Howe proxima, sed differt thallo minore, crassiore, magis lobato, non-nitente, membrana superficiali communi duplo crassiore, cellulis superficialibus inter se duplo distantioribus, filamentis medullaribus dimidio minus crassis et minus regulariter et minus manifesto capitatis in strato subcorticali abientibus, cellulis intimis strati subcorticalis saepe

multum majoribus, magis echinato-stellatis, cum processubus subspinescentibus saepe permultis.

Ad oras Insularum Bermudensium, in profundis (typo in herb. Hort. Reg. Kew., a Exped. "Challenger" lecto et "*Kallymenia reniformis*" denominato).

Frond membranous, gelatinous, 125–200 μ thick (when soaked out), suborbicular in general outline, attaining width of 10–18 cm., deeply, irregularly or subpalmately lobed or divided, the lobes irregularly obovate or suborbicular, mostly 2–6 cm. broad, their margins sinuate- or erose-dentate or sparingly sublobulate; surface dull; color (dried) light grayish vinaceous to Persian lilac;* medulla of frond subvacuous or loosely filamentous, its filaments homogeneous, mostly 10–14 μ in diameter (including gelatinous walls; protoplasts commonly only 1–4 μ); cortex of frond gelatinous, translucent, submonostromatic, the superficial cells (protoplasts) ovoid, subglobose, or ellipsoid, 4–8 μ in maximum diameter, widely spaced (separated 5–10 μ), their longer axes horizontal or vertical, their outer walls ("surface jelly") 10–18 μ thick; subcortex of 2–4 layers of closely anastomosing, ovoid, ellipsoid, or often flattened, thick-walled cells, the outer (protoplasts) granular, 6–10 μ in diameter, the inner mostly 25–65 μ in maximum diameter, some of the inner cells larger, subglobose, 80–180 μ in diameter, echinate-stelliform, projecting into the medullary cavity and showing when detached 15–40 rather rigid subspinescent processes, these mostly 25–60 μ long and 10–20 μ in diameter at base; other parts unknown.

BERMUDA: Dredged in "31 fathoms, off Bermuda" by members of the Challenger Expedition in 1873, and reported as "*Kallymenia reniformis* J. G. Agardh" (Rep. Voy. Challenger, Bot. 1: Bermudas 117. 1884). This is the only specimen known to the present writers.

TYPE: In the herbarium of the Royal Botanic Gardens, Kew, England.

Halymenia echinophysa appears to find its nearest ally in *H. actinophysa* M. A. Howe,† from La Paz, Lower California, but differs in the smaller, thicker, more lobed, non-nitent thallus, with the surface jelly twice as thick, the surface cells twice as widely spaced, the medullary filaments one half as stout, in the less regularly and less obviously capitate terminations of these

* Ridgway, loc. cit. *pl. 38, 39.*

† Bull. Torrey Club **38**: 509. *pl. 34.* 1911.

filaments in the subcortex, and in the often much larger, more numerously and more echinately branched stelliform cells of the inner subcortex.

From *H. bermudensis* Collins & Howe, to certain forms of which it bears a superficial resemblance, it differs in being much more gelatinous, in the much thicker surface jelly or outer walls of the superficial cells (10–18 μ vs. 2–4 μ thick), in the more generally monostromatic cortex, in the more widely spaced (5–10 μ vs. 2–3 μ) protoplasts of the superficial cells, in having a medulla that is filamentous and homogeneous instead of showing a system of substellate ganglia with refringent specialized protoplasts, and in the presence in the inner subcortex of cells that are 80–180 μ in diameter with 15–40 subspinescent processes, while the inner cells of the subcortex of *H. bermudensis* are 13–25 μ in diameter and have no obvious appendages.

When the enlarged echinate-stelliform cells of the inner cortex are detached, some of their numerous sharp-pointed processes show apices that look as if they had been free from all cell connections, but most of them show at the apex traces of a septum to which they have narrowed down and at which point they have been disjoined from their former cell connections. The protoplasts of these large echinate cells are similar to those of their neighbors or are more vacuous, wherein they differ greatly from the substellate medullary ganglia of *H. bermudensis* and *H. floridana*, the protoplasts of which are conspicuously different from those of the ordinary cells in being denser, more homogeneous, and more refringent. As is the case in *H. actinophysa*, the cells of the subcortex of *H. echinophysa* are so gelatinous and translucent that their form and relations can not well be ascertained without resort to staining reagents, such as solutions of haematoxylin.

Of the four species above described, specimens of three, *Halymenia Gelinaria*, *H. pseudofloresia*, and *H. bermudensis*, have already been distributed in the Phycotheca Boreali-Americana of Collins, Holden & Setchell, as indicated. This will, we trust, in a measure atone for the lack of illustrations in the present paper.

Desmopsis, a new genus of Annonaceae

WILLIAM EDWIN SAFFORD

(WITH PLATES 7–9 AND ONE TEXT FIGURE)

The genus *Unona* was based by the younger Linnaeus on an American plant, the *peyrico-boom* of Surinam, belonging to the previously established genus *Xylopia*. Its type, *Unona discreta* L. f., is identical with either *Xylopia frutescens* Aubl. or *X. salicifolia* Dunal, and is certainly not congeneric with the Asiatic plants usually referred to the genus *Unona*. Recognizing that *Unona* must become a synonym of *Xylopia* and that the name could no longer be used for any other genus, the writer restored the generic name *Desmos*, established by Loureiro in 1790, for the Asiatic *Unona discolor*, believed by Vahl (1791) to be a congener of the American *U. discreta* but which proved to be identical with Loureiro's *Desmos chinensis*. The type of Loureiro's genus, *Desmos cochinchinensis*, was arbitrarily renamed by Dunal (1817) *Unona Desmos*. The necessity of restoring the generic name *Desmos** in accordance with accepted rules of nomenclature was recognized by Mr. Elmer D. Merrill, in his "Studies on Philippine Annonaceae."†

That there are no American species congeneric with *Desmos* (*Unona* Vahl) was recognized by the writer, who in the publication above cited referred *Unona panamensis* Robinson and *U. bibracteata* Robinson to *Unonopsis*, established by Robert E. Fries in 1900. A further study of the genus *Unonopsis*, however, showed that Fries included in it plants differing widely in inflorescence and in the number and arrangement of the ovules. In proposing

* "*Desmos* the proper generic name for the so-called Unonas of the Old World." Bull. Torrey Club **39**: 501–508. 1912.

† "Safford has recently conclusively shown that the genus *Unona* Linn. f. was based upon an American species, *Unona discreta* Linn. f., and that Vahl was in error in placing under *Unona* the Asiatic *U. discolor* Vahl, *Desmos chinensis* Lour. The Indo-Malayan material that has by various authors been referred to *Unona* cannot properly be considered under this generic designation, and Safford has correctly taken up the generic appelation *Desmos* for the oriental forms, this genus having been proposed by Loureiro in 1790." Phil. Jour. Sci. Bot. **10**: 234. 1915.

the genus *Unonopsis*, based chiefly upon plants which had been previously included in *Trigyneia*, Fries himself realized that the genus would probably have to be subdivided or even resolved into distinct genera.* This natural division must be made, retaining for the genus *Unonopsis* the typical *Unonopsis angustifolia* (Benth.) Fries, together with *U. Perottetii* (A.DC.) Fries, and *U. rufescens* (Baill.) Fries, with clusters of small globose pisiform long-pedicelled flowers, usually growing from the axils of fallen leaves, on the old wood. Quite distinct from these in the form of flowers and the number and arrangement of the ovules are the two species *Unona panamensis* and *Unona bibracteata* mentioned above, and I here propose for them the generic name *Desmopsis*, which is suggested by their resemblance to the genus *Desmos* of the Old World. To *Desmopsis* must also be referred *Trigyneia Galeottiana* Baill. and an undescribed species recently collected by Mr. William R. Maxon and Professor Henry Pittier in the Republic of Panama.

FIG. 1. Pistils, fruit and seed of *Desmos*. *a*, Pistil of *Desmos cochinchinensis* Lour. (*Unona Desmos* Dunal), showing pilose ovary and glabrous style; *b*, pistil of *Desmos chinensis* Lour. (*Unona discolor* Vahl); *c*, *d*, fruit and seed of the same. *a* and *b* enlarged, *c* and *d* natural size.

DESMOPSIS Safford, gen. nov.

Peduncles opposite the leaves or terminal, bearing at the extremity one or two broadly ovate or suborbicular cordate leaf-like bracts, and one or two (rarely three) long slender curved pedicels. Calyx segments three, valvate, broadly ovate or triangular. Petals six, equal or nearly so, lanceolate to linear-oblong, continuing to elongate after anthesis, valvate, in two series, ascending, sometimes incurved at the apex. Stamens numerous, short, cuneate, with the connective broadly expanded into a concave disc above the two pollen sacs. Torus convex or subcylindrical, pilose between the stamens and the carpels. Carpels seven to nineteen. Ovaries pilose. Ovules two to six, two-seriate, parietal, forming a single column. Style depressed-spheroid, densely clothed with short hairs. Fruit a cluster of stipitate

* Beiträge zur Kenntnis der süd-amerikanischen Anonaceen, Kongl. Svenska Vetensk Akad. Handl. 31: 26. 1900.

subglobose, oval, or oblong one- to six-seeded berries, often more or less constricted between the seeds but never moniliform. Seeds horizontal, discoid, usually with a peripheral groove, the terminal ones depressed-hemispherical, or, if solitary, spheroidal; endosperm ruminate and embryo minute, as in all Annonaceae. Shrubs or small trees with alternate short-petioled entire leaves, and yellowish or greenish solitary or geminate flowers, often very fragrant, on long slender curved pedicels borne by short, bracted, leaf-opposed peduncles, and followed by clusters of pedicelled berries.

TYPE: DESMOPSIS PANAMENSIS (Robinson) Safford.

GEOGRAPHICAL RANGE: From the state of Vera Cruz, Mexico, to the Isthmus of Panama.

This genus differs from the Old World *Desmos* in its peculiar bracted leaf-opposed inflorescence, the pilose indument of the torus between the stamens as well as between the carpels, the depressed-globose hairy styles, and the crowded discoid seeds marked with a peripheral groove, separated from each other by a slight constriction but never enclosed in a moniliform pericarp. In typical species of *Desmos* (*Unona* Vahl) the mature carpels are moniliform (FIG. 1) the seeds devoid of a groove round their periphery, and the styles are not hairy.

Key to the species

Leaves not acuminate, narrowed to an obtuse or rounded apex, oblong-lanceolate or rhomboid, glabrous or nearly so. 4. *D. bibracteata.*

Leaves acuminate.

Lanceolate-elliptical, often unequal at the base, lower surface hirtellous-tomentose. 2. *D. Galeottiana.*

Elliptical or oblong, symmetrical at the base.

Petals incurved at the tips; leaves rufous-pubescent along the midrib and nerves beneath. 1. *D. panamensis.*

Petals not incurved at the tips; leaves almost quite glabrous beneath. 3. *D. Maxonii.*

1. **Desmopsis panamensis** (Robinson) Safford

Unona panamensis Robinson, Am. Jour. Sci. III. 50: 175. 1895.

A small symmetrical tree 5–8 m. high with horizontal limbs and a straight trunk covered with brownish gray bark. Branches brown with lighter colored lenticels; young growth finely rufous-tomentose with simple hairs. Leaves short-petioled, oblong or elliptic, shortly acuminate, narrowed or cuneate at the base, entire, 10–20 cm. long and 4.5–8 cm. broad, glabrous above, when young covered beneath with an appressed rufous silky pubescence, at length pubescent beneath only upon the nerves. Flowers greenish

yellow; peduncle short (5–10 mm. long), bearing at the summit a suborbicular cordate bract about 1 cm. in diameter (rarely larger and more like the leaves, rarely absent) and one or two elongated pedicels (4–9 cm. long), slightly thickened near their summits, these rarely bearing a small clasping suborbicular bract about 4 mm. broad below the middle. Calyx three-parted, with the segments ovate-triangular, 2–3 mm. long; petals six, equal, lance-linear, 15–25 mm. long, never widely spreading, the tips incurved and the edges revolute, finely pubescent on the outside and covered with minute yellowish green granules on the inner surface; torus convex or depressed-hemispherical, thickly covered with short straight fulvous hairs and bearing numerous closely crowded stamens surrounding the gynoecium; stamens 1.5 mm. long, with the brown connective broadly expanded above the two parallel pale straw-colored pollen sacs into a concave thickish disk; carpels seven to fifteen, ovaries 2 mm. long, clothed with fulvous hairs, containing two to eight ovules in a single vertical column and bearing a subglobose brown stigma clothed with short erect hairs; maturing carpels five to twelve, stipitate, oval to oblong, 14–18 mm. long and 10–14 mm. in diameter, very slightly constricted between the seeds, and rounded at each end; stipe (carpophore) 8–10 mm. long and 1.5–2 mm. thick; seeds two to six, disk-shaped, with an impressed line around the periphery, those at the ends depressed hemispherical. [PLATE 7.]

Type in the Gray Herbarium of Harvard University, collected by Sutton Hayes in "woods near Gatún Station on the old Panama Railway, January 30, 1860." Specimen of type collection in United States National Herbarium bearing same data (sheet No. 314144).

DISTRIBUTION: Known only from the Panama Canal Zone.

SPECIMENS EXAMINED

PANAMA: Type as cited; same locality and data (type collection) in United States National Herbarium (sheet No. 314144); in forest, railroad relocation Caimito and New Frijoles, Canal Zone, altitude 10–50 m., "5 to 8 m., fls. yellow," January 7, 1911, *Pittier 2269;* hills around the Agua Clara Reservoir, near Gatún, Canal Zone, altitude 20–30 m., "a little tree with straight trunk 4 meters high, flowers greenish yellow," February 5, 1911, *Pittier 2660.*

This interesting species, hitherto known only from the type collection, was collected by Professor Henry Pittier during his

recent botanical exploration of Panama very nearly on the exact spot where Dr. Sutton Hayes found it. Professor Pittier reports it as "a small tree 5 to 8 meters high and regularly shaped. The straight trunk, covered with a brownish gray bark, is not divided but sends out radiating horizontal limbs, the extremities of which are slightly pendulous, and which are shorter toward the top, so as to form a pyramidal crown."

2. **Desmopsis Galeottiana** (Baill.) Safford

Trigyneia Galeottiana Baill. Adansonia **8**: 181. 1868.

A shrub or small tree with slender branches, at length glabrate. Young growth hirtellous-tomentose with simple yellowish hairs. Leaves short-petioled, elliptic-lanceolate, shortly acuminate, obtuse at the tip and usually unsymmetrically cuneate at the base, above bright green, glabrate except along the impressed midrib, beneath fulvous tomentose-hirtellous especially along the prominent midrib and the primary nerves. Flowers green (according to Galeotti), borne on long slender curved pedicels, these solitary or in pairs (rarely in three's) growing from a short peduncle and subtended by a leaf-like elliptical or cordate bract with nerves and indument like the leaves; peduncle terminal or opposite a leaf, about 8 mm. long, at length woody and branch-like; pedicels recurved, 40–50 mm. long, at first filiform and hirtellous and bearing a small ovate clasping bract below the middle, at length glabrate and bractless. Calyx three-parted, the divisions short and usually acute, pubescent on the outside. Petals six, equal or nearly so, valvate, in two series, ovate-lanceolate, rather thick, usually acute at the apex, puberulous on the outside. Stamens numerous, borne on a convex torus, with the connective expanded above the linear pollen sacs into a broad more or less concave disk. Carpels (in specimens examined) seven to eleven; ovary oblong, tomentose, bearing the subglobose blackish style, the latter articulated at the base and easily detached. Ovules two to six in each ovary, arranged in a single vertical row. Fruit a cluster of several stipitate berries (mature carpels) radiating from the indurated receptacle (torus), these oblong or subglobose, puberulent at first, at length glabrate; stipes 4–6 mm. long and 1.5 mm. thick, straight or curving slightly upward; seeds one to four, discoid, or if solitary subglobose, endosperm ruminate as in all Annonaceae.

Type in Herbarium of Copenhagen, "Anonac. Mexic. Liebm. No. 153," collected at Palanque, state of Vera Cruz, Mexico, in March, 1841, by Liebmann (No. 7); cotypes in Paris Museum and

Herbarium Delessert, collected at Jalapa, altitude 2000 feet, by Galeotti (Nos. 4066 and 7083).

DISTRIBUTION: Known only from the *tierra templada* of the state of Vera Cruz, Mexico.

SPECIMEN EXAMINED:

MEXICO: Near Orizaba, 1500 feet, July, *Dr. C. Sartorius*, in United States National Herbarium, Sheet No. 2571; and the following sheets belonging to the Copenhagen Herbarium: Palanque, *Liebmann 7* (type, as cited, with duplicate bearing the same data); Colipa, *Liebmann 5, 6, 9;* Mirador, *Liebmann 4, 19;* between Mirador and Jalapa, *Liebmann 1;* San Pablo, *Liebmann 10.*

For the opportnnity of examining the Liebmann material I am indebted to Dr. C. H. Ostenfeld, Director of the Copenhagen Herbarium. Since specimens from several localities are cited by Baillon in the original description of this species, and it is possible that differences may subsequently be found between plants growing remote from one another, it becomes necessary to designate one specimen as the type. I have therefore selected as the type Liebmann's No. 7 (sheet No. 153), including leaves, flowers, and mature fruit, since this number represents the species more completely than any of the others. This speciman therefore becomes the type of *Desmopsis Galeottiana;* and Palanque, near Colipa, in the state of Vera Cruz, Mexico, must be designated as its type locality.

3. **Desmopsis Maxonii** sp. nov.

A small tree 5–7 m. high. Branches slender, brown with numerous lenticels; young growth clothed with appressed pale fulvous hairs. Leaves broadly elliptical to elliptical-oblong or lanceolate acuminate, narrowed at the base into the short petiole, the smaller ones about 10 cm. long and 3.8 cm. broad, gradually acuminate, the larger ones 12–14 cm. long and 6–8 cm. broad, abruptly acuminate, with the petiole about 5 mm. long, relatively thick and grooved above, with the acute base of the blade decurrent upon it, glabrous above, covered beneath when young with pale fulvous silky hairs, at length quite glabrous. Flowers straw-colored, or pale yellow, fragrant with the odor of banana; peduncle 7–14 mm. long, opposite a leaf, or apparently terminating a branchlet, normally bearing at the summit a suborbicular or broadly ovate clasping leaf-like bract 7–15 mm. broad and (in the specimens

observed) a solitary elongated very slender recurved pedicel 3.5–6 cm. long, thickened at the summit, clothed when very young with a few minute sparse appressed pale fulvous hairs, soon becoming quite glabrous, bearing a minute clasping bract below the middle and often a similar bract at the base adjacent to the much larger bract terminating the peduncle. Calyx-segments broadly triangular, 4 mm. long; petals equal, elongating after anthesis, linear-oblong, 13–18 mm. long, 4–5 mm. broad, obtuse at the apex, pubescent on the outside with minute appressed grayish hairs, dark brown (in dried specimens) on the inside. Stamens numerous, resembling those of *Desmopsis panamensis* in size and form, their closely crowded concave expanded connectives forming, before anthesis, a tight domelike pavement over the androecium, protecting the pollen until the pollen sacs are ready to open. Gynoecium composed of a cluster of ten to fifteen carpels, with the ovaries, about 2 mm. long, clothed densely with silky hairs, at first dirty white, at length olivaceous, ovaries in a single ovary two to five, stigmas depressed-globose, covered with short hairs, adhering together in a dark brown mass after pollination and soon falling off. Fruit a cluster of short-stiped or nearly sessile one- to three-seeded spheroid or ovoid berries, scarcely at all constricted between the seeds, about 8 mm. in diameter, seeds discoid, horizontal, forming a single column. Stipes 1–3 mm. long (in the type) and 1.5–2 mm. in thickness. [PLATE 8.]

Type in the United States National Herbarium (sheet No. 677550), collected by Henry Pittier in the forest near El Boquete, Chiriquí, Republic of Panama, at an altitude of 1,000 to 1,300 meters, March 16, 1911 (No. 3154). Cotype (with flowers only) collected by William R. Maxon in the humid forest along the upper Caldera River, near Camp I, Holcomb's trail, above El Boquete, Chiriquí, altitude 1,450–1,650 meters, March 22–24, 1911 (No. 5564).

DISTRIBUTION: Known only from the vicinity of El Boquete, Chiriquí, Republic of Panama.

SPECIMENS EXAMINED

Type as cited and two additional sheets of type collection; cotype, as cited, with flowers only.

This species, like *Desmopsis bibracteata*, is remarkable for the banana-like fragrance of its flowers. It is easily distinguished from that species by its much broader, acuminate leaves, the much shorter and thicker stipes of the fruit, and the absence of constrictions between the seeds.

4. Desmopsis bibracteata (Robinson) Safford

Unona bibracteata Robinson, Am. Jour. Sci. III. **50**: 175. 1895.

A shrub or small tree with slender branches. Very young branchlets minutely hirtellous, soon glabrous or nearly so. Leaves not acuminate, oblong-lanceolate or rhomboid, sometimes slightly falcate, narrowed to an obtuse or rounded apex, connected below to a very short thickish petiole, when very young clothed beneath with fulvous hairs, at length green and glabrous on both surfaces, 5.5–14 cm. long, 2.5–4 cm. broad, firm but not coriaceous in texture. Flowers light yellow, very fragrant, borne on very slender wiry recurved pedicels about 2.5 cm. long, subtended by a suborbicular cordate bract about 1.3 cm. in diameter and sometimes bearing a minute clasping bract below the middle, rarely a second flower growing from the axil of the basal bract; peduncle opposite a leaf, very short (2–5 mm. long). Calyx three-parted, the segments broadly ovate, rounded at the apex, to 5 mm. long. Petals increasing in length after anthesis, at first broadly ovate, densely clothed on the outside with pale grayish brown hairs, at length linear-oblong, about 18 mm. long and 5–6 mm. broad, obtuse or rounded at the tips, and glabrous or nearly so, with the edges usually revolute. Stamens numerous, about 1.5 mm. long, broadly cuneate, the brown connective expanded above the pale yellow pollen sacs in the form of a thick concave saucer-shaped disk. Carpels fourteen to twenty, sessile at first, ovaries oblong, clothed with whitish or pale yellowish ascending hairs and bearing a depressed-spheroid glandular hairy brown style, styles constricted at the base, adhering together after pollination, and soon falling off in a mass. Fruit a cluster of slender-pedicelled two- or three-seeded berries, red when fresh, at length turning brown, covered with appressed hairs when young, at length glabrate, pericarp thin, constricted between the seeds, these arranged in a vertical row, disk-shaped, 5–7 mm. in diameter, marked with a groove around the periphery, the end one depressed-hemispherical or convex on one side; stipes (carpophores) slender and wire-like, 5–8 mm. long, 1 mm. thick. [PLATE 9.]

Type in the Gray Herbarium of Harvard University, collected by Charles Wright in Nicaragua, on the North Pacific Exploring Expedition under Commanders Ringgold and Rodgers in 1855 (No. 1), bearing the label "*Unona violacea* Dun. aff." Duplicate of the type bearing the same data in the United States National Herbarium (sheet No. 2517).

DISTRIBUTION: From Nicaragua to Chiriquí, Republic of Panama.

SPECIMENS EXAMINED

NICARAGUA: Type and duplicate of type as cited.

COSTA RICA: "Terrenos incultos, Nuestro Amo, alt. 500 metros, arbusto de flores olorosas, nom. vulg. 'guineo,'" March, 1912, *Otón Jiménez 416*, in United States National Herbarium.

PANAMA: Vicinity of David, Chiriquí, altitude 30–80 m., small tree, flowers sulphur yellow, fruit red, March 25, 1911, *H. Pittier 3367;* vicinity of San Feliz, eastern Chiriquí, altitude 0–120 m., tree about 3 m. high, flowers yellow, having the fragrance of a banana, and hence called "flor de guineo," *H. Pittier 5747*, in United States National Herbarium.

ADDENDUM

After receiving the proof of the above descriptions the writer came upon an additional species of *Desmopsis* among the Annonaceae of the Copenhagen Herbarium lent him for study. This species I have named in honor of its collector.

5. **Desmopsis Oerstedii** sp. nov.

A shrub or small tree with the young growth, petioles, midrib beneath, peduncles, and pedicels densely fulvous-hirtellous with soft simple hairs projecting outward. Leaves short-petioled, the blade resembling that of *D. panamensis* in shape, elliptic or elliptic-oblong, shortly acuminate at the apex and narrowed or acute at the base, 10–13 cm. long, 4–5 cm. broad. Flowers not observed. Fruiting peduncle (normally terminating in a small leaf-like bract) leaf-opposed, 1 cm. long; pedicels (solitary in type material) 2–4 cm. long, clothed with persistent spreading fulvous hairs; bract separating the peduncle from the pedicel broadly cordate, 5 mm. long, sessile, sometimes missing. Maturing carpels usually about seven, subglobose to oval, 12–24 mm. long and 10–12 mm. in diameter, not constricted between the seeds, rounded at the apex, and narrowed at the base into a short stipe 5–7 mm. long and 2–3 mm. thick. Seeds four to six, horizontal, discoid and circular, 9–10 mm. in diameter, or surfaces beveled at an acute angle and more or less semicircular in outline, those of the two rows overlapping alternately, the testa light brown, thin, wrinkled by the inclosed ruminate endosperm, and marked by an impressed line around the periphery.

Type in the Botanical Museum of Copenhagen, collected by Anders Sandöe Oersted on Mount Aguacate, Costa Rica, in November, 1847, Plantae Centro-Americanae Oersted No. 148, bearing the generic name "*Guatteria*."

DISTRIBUTION: known only from the province of Alajuela, Costa Rica.

SPECIMENS EXAMINED

COSTA RICA: Type material, as cited (three sheets); also *Oersted 149*, collected "in Monte Jaris, Nov. 1846." Common name, "Guinea."

The common name applied to this plant in Costa Rica is the same as that applied to *Desmopsis bibracteata*, as quoted by Jiménez, except it has a feminine instead of a masculine ending. It is undoubtedly derived from the banana ("guineo") odor of the flowers. In the specimens examined fruits only were observed. These differ from the fruits of all the other species observed in their larger size, and the alternate arrangement of the seeds, somewhat after the manner of the seeds of Asimina and Sapranthus. The leaves differ from those of *D. panamensis* in the indument of the midrib beneath, which is densely fulvous-hirtellous; and the species is easily distinguished from *D. Maxonii* by its much shorter floral pedicels. From *D. bibracteata* it is at once distinguished by the shape of the leaves.

This species and *D. bibracteata* would be desirable additions to the cultivated shrubs of the warmer parts of the United States on account of the fragrance of their flowers. Those of the latter species are much used by Spanish Americans in decorating their altars.

BUREAU OF PLANT INDUSTRY,
UNITED STATES DEPARTMENT OF AGRICULTURE

Explanation of plates 7–9

PLATE 7

DESMOPSIS PANAMENSIS (Robinson) Safford

Showing flowers, fruit and essential parts. *a*, Short peduncle terminating in leaf-like bract; *b*, elongated pedicels; *c*, torus devoid of stamens and bearing cluster of young carpels; *d*, stamen, showing concave connective expanded above pollen sacs; *e*, ovary bearing depressed spheroid hairy style; *f*, cluster of mature stiped carpels; *g*, carpel, showing column of discoid seeds; *h*, seed, lateral view; *i*, terminal seed, showing convex surface; *d*, *e*, enlarged; remaining parts natural size. Drawn by Theodore Bolton from the type specimen.

PLATE 8

DESMOPSIS MAXONII Safford

a, Short peduncle terminating in leaf-like bract; *b*, elongated pedicel bearing small bracts at its base and below its middle; *c*, essential parts, showing cluster of carpels tipped with hairy styles surrounded by the stamens; *d*, stamen; *e*, cluster of young carpels from which styles have become detached; *f*, fruit, showing short-stiped carpels (nearly mature); *g*, a fruit (berry) with part of pericarp removed so as to show the seeds. Branches with flower, fruit and leaves, natural size; *c* and *d* enlarged. Drawn by Mrs. R. E. Gamble from the type specimen.

PLATE 9

DESMOPSIS BIBRACTEATA (Robinson) Safford

a, Cluster of fruit; *b*, seeds. Natural size. Drawn by Theodore Bolton from type material in the United States National Herbarium.

Observations on the fern rust Hyalopsora Polypodii

E. T. Bartholomew

(WITH THREE TEXT FIGURES)

A study of this rust on *Cystopteris fragilis* (L.) Bernh. was undertaken in order if possible to bring together the somewhat widely varying statements of different writers with reference to its life history.

Lindau* states that *Hyalopsora Polypodii* (Pers.) Magn. has teliospores and uredinia, but no aecia, and that the uredinia have no peridia. Grove† describes teliospores and uredinia but no aecia; the uredinia, with no peridium, containing yellow, sessile spores of two kinds, respectively thick- and thin-walled, both repeatedly found in the same sorus. In his artificial infection experiments, Dietel‡ found that the first uredinia contained only thin-walled spores; later, however, thick-walled spores also were found among the thin-walled spores and in many of the uredinia formed still later, the majority of the spores were thick-walled. Arthur§ describes the two kinds of yellow spores, which for convenience he considers respectively aeciospores and urediniospores, as being in separate sori; the aecia, containing the thick-walled spores, being without a peridium, and the uredinia, containing the thin-walled spores, having only a very delicate peridium; both kinds of spores borne singly on pedicels.

The observations recorded in the present paper were obtained in two ways; by a study of fresh material both in the field and in the greenhouse, and by that of fixed and sectioned material. In both field and greenhouse considerable difference was noted between the appearances of the sori produced in cloudy weather and of those produced during a period of sunshine. Several times during the months of May and June there were periods of cloudy weather

* Kryptogamenflora für Anfänger 2. Berlin. 1912.

† The British Rust Fungi 375. Cambridge. 1913.

‡ Ueber einige Kulturversuche mit *Hyalopsora Polypodii* (Pers.) Magn. Ann. Mycol. 9: 530–533. 1911.

§ No. Am. Flora 7: 112. 1907.

lasting from three or four days to a week or more. During these periods the sori remained pale gray, but within twenty-four hours after the sun appeared they assumed a bright orange color. In contrast to this history, the sori that developed during the bright periods began to take on the yellow color even while they were quite small. Often a marked difference could also be noticed between the sori on shaded and on unshaded fronds—those on the former remaining gray for a considerable length of time, while the sori on the latter began to turn yellow almost as soon as they were noticeable.

It is not difficult to dissect an infected pinna in such a manner that large masses of the mycelium may be obtained free from the host tissues. To do this most effectively, it was found best to soak the pinnae in Flemming's weak fixing fluid for two or three

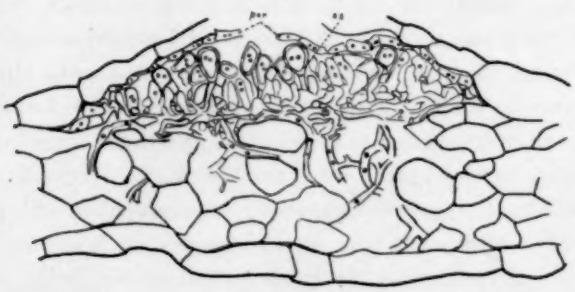

FIG. 1. Section through fixed and stained sorus, showing the peridium (*per*) and stalked spores (*ss*), × about 390. Camera lucida drawing.

hours, then to wash them in water for about the same length of time and afterward to dehydrate them by running them through a series of progressively stronger solutions of alcohol up to 95 per cent. A sorus was then cut from a pinna and dissected under a binocular microscope. Not only could mats of the mycelium be easily obtained in this manner, but in some cases rust spores remained attached to the hyphae. Often among the separated spores one was found with its short stalk still attached. This made it plain that the spores are not sessile as stated by Grove, but that, as Arthur says, they are borne on short stalks. This observation was verified by the study of sectioned and stained preparations (FIG. 1).

In studying stained sections of a very large number of sori which had not yet broken open, not one was found without a peridium. FIG. 1 shows a typical sorus just as it is breaking open. Ordinarily, though not always, by the time the sorus has become erumpent, the peridial cells have distintegrated to such an extent that they are scarcely noticeable. In the material which was dissected with needles the peridial cells could easily be distinguished.

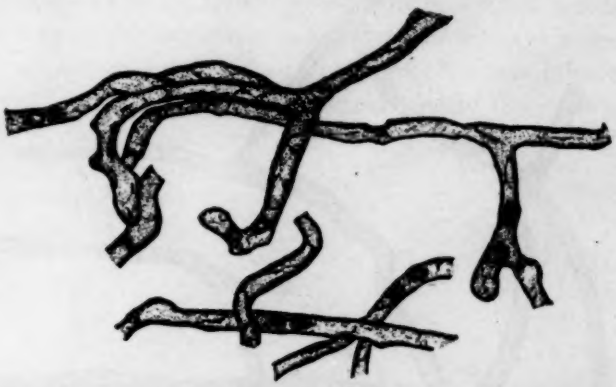

FIG. 2. Fragments of binucleate hyphae taken from the base of a sorus in which most of the spores were thick-walled. × about 700. Camera lucida drawing.

Perhaps the most interesting part of the results of this investigation concerned the nuclear condition of the hyphae. The mats of mycelium which had been freed from the host tissues were transferred to separate slides and stained *in toto*. Without exception the cells of these hyphae were found to be binucleate. This was true of hyphae taken from the bases of sori in which the majority of the spores were thick-walled, as well as of those taken from the bases of sori containing mostly thin-walled spores. Small fragments of the mycelium are shown in FIGS. 2 and 3. Sectioned material shows the same facts as to the binucleate condition of the hyphae.

From these observations it would seem that there can no longer be any basis for calling the thick-walled spores aeciospores and the thin-walled spores urediniospores. This conclusion would indicate that there must be an aecial host for this rust, and although Bubak* has been unsuccessful in his attempts to inoculate species

* Infektionsversuche mit einigen Uredineen. Centralb. Bakt. Zweite Abt. **12**: 411–426. 1904; **16**: 150–159. 1906.

of *Abies* and *Pinus* with *Hyalopsora*, future workers will probably find the aecial host of *Hyalopsora* as has been done for different species of *Uredinopsis*.

An explanation for the production of two kinds of urediniospores at the present time may be at least suggested.* Of the

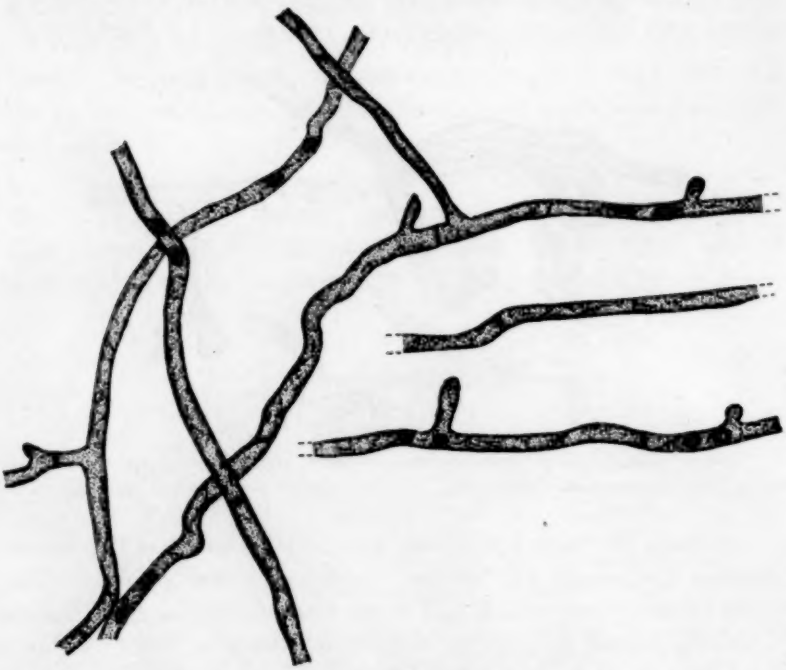

FIG. 3. Fragments of binucleate hyphae taken from the base of a sorus in which most of the spores were thin-walled, × about 680. Camera lucida drawing.

groups of plants which now serve as hosts to the various rusts, the pteridophytes are the oldest. This gives some ground for assuming that the fern rusts are the most ancient of the rusts now living. Following the pteridophytes came the gymnosperms, and it is upon the conifers of this group that, as far as is now known, the aecial stage of the fern rusts appears. We may suppose, then, that some of the conifers became susceptible to infection by one stage of the rusts already parasitic upon the pteridophytes. It follows that one of the present spore forms of the fern rusts is a

* This suggestion was first made to the writer by Dr. J. J. Davis of this laboratory.

relic of an autoecious condition which prevailed in connection with a uninucleate mycelium that developed from a sporidial infection. As a result of the passing of the aecial stage to the conifers, only binucleate mycelial stages are now found in the ferns. From the persistence of the primitive spore form under the changed conditions, one may infer that the autoecious condition in the history of these rusts existed for a long period of time. While not germane to the question as to the spore forms of the fern rusts, it may not be amiss to carry the speculation a little further with the suggestion that the angiosperms upon their appearance became infected by aeciospores from conifers, and that consequently the most primitive rusts of phanerogams bear their aecia upon coniferous hosts.

UNIVERSITY OF WISCONSIN,
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INDEX TO AMERICAN BOTANICAL LITERATURE

1907-1916

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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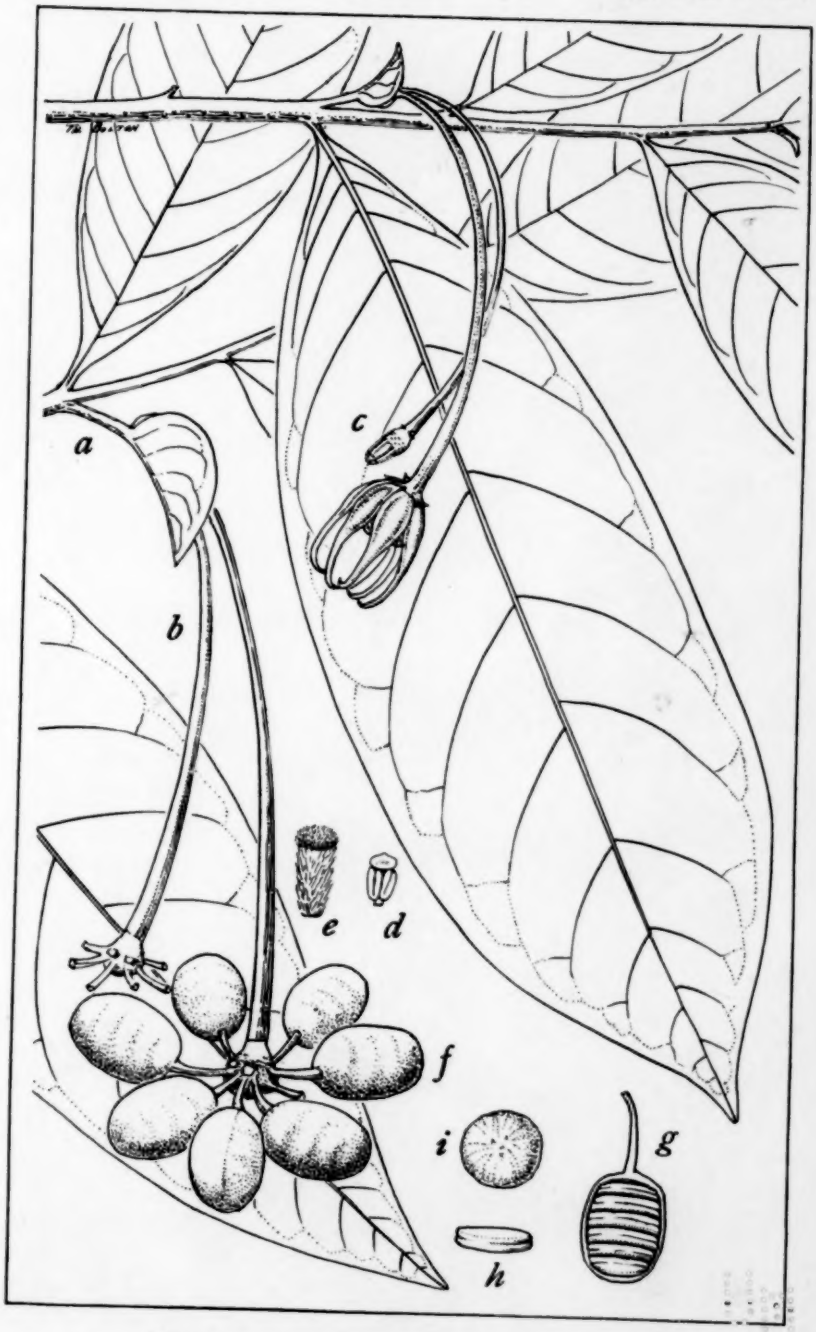
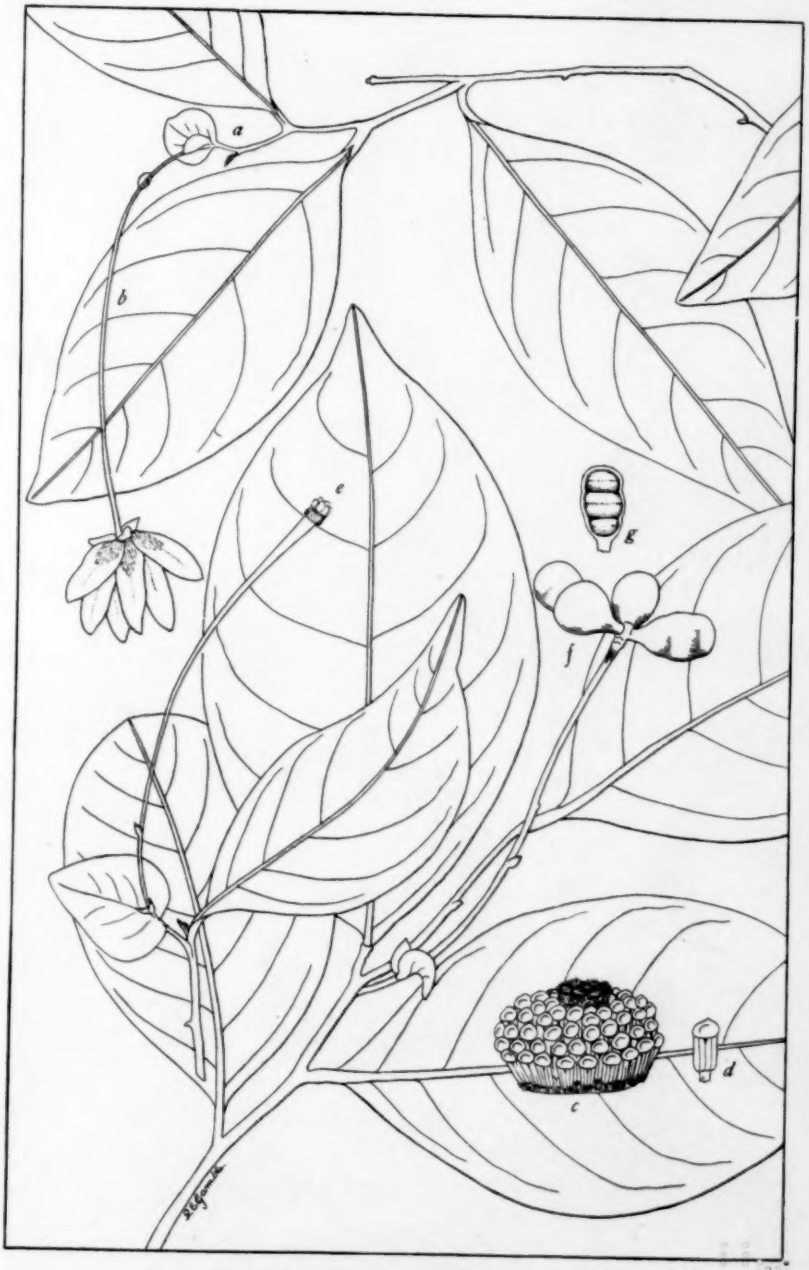


DESMOPSIS PANAMENSIS (ROBINSON) SAFFORD



DESMOPSIS MAXONII SAFFORD

DESMOPSIS BIBRACTEATA (ROBINSON) SAFFORD